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Errit Lough Sand and Gravel Aquifer Summary of Initial Characterisation



GW3D Project Report TR2023/62
July 2023

Errit Lough Sand and Gravel Aquifer Description July 2023

This sand and gravel report forms part of a series representing the output of a body of work undertaken to re-evaluate previously mapped sand and gravel aquifers and to identify new sand and gravel aquifers. This study resulted in the refinement of existing sand and gravel aquifer mapped extents, the modification of some sand and gravel aquifer categories, and the removal of some previously mapped sand and gravel aquifers, as well as identification of new aquifers. In addition to mapping the extent and depths of the sand and gravel aquifers, the investigations consider the hydraulic properties.

The study, undertaken as part of the GW3D project (2015-2019), comprised three parts:

1) Desk study and fieldwork preparation

Sand and gravel bodies above a minimum size criterion were extracted from the GSI Quaternary Sediments 1:50,000 map. Where it was known that the surface expression of the sands and gravels was only a small portion of the subsurface body, such areas were retained. This process left several hundred sand and gravel bodies remaining as a starting point for field work.

2) Fieldwork including mapping and data collection

Field work included a visit to each of the areas which had the potential to be (at least) a Locally Important Sand and Gravel Aquifer owing to its area. In such areas, gravel pits and sand pits were visited and depth and type of sediment recorded, other exposures into the subsurface were visited and logged, wells (whether Public Supply, Group Scheme or private farm or domestic) were dipped and any information on depths recorded, and data was collected where geological and hydrogeological data existed for the area.

3) Data collation, analysis and reporting.

All field data, and information from earlier reports and studies, were compiled and analysed. Where a sand and gravel body had qualifying aquifer properties (either 10 m depth sand and gravel, or 5 m depth saturated sediments), these areas were digitised in a GIS. The aquifer area was then ascertained and drawn up. Such areas formed the basic building blocks for the sand and gravel aquifer map, which included details on the aquifer name, area, aquifer resource value (Rg or Lg), confidence level, county, and any important aspects to note for each body.

The updated mapped sand and gravel aquifers are found on the Geological Survey Ireland site <https://www.gsi.ie/en-ie/data-and-maps/Pages/Groundwater.aspx#Aquifers>

The GW3D Mapping Team involved in the current revision of delineated sand and gravel aquifers were:

Geological Survey Ireland staff:

- Dr. Sophie O'Connor, Groundwater Programme / Land Mapping Unit
- Dr. Sarah Blake, Groundwater Programme

Consultant support:

- Dr. Robbie Meehan, Talamh Ireland
- Coran Kelly, Tobin Consulting Engineers
- Damien Doherty, independent Consultant Geologist/ Tobin Consulting Engineers
- Natalie Duncan, independent Consultant Geologist
- Sara Raymond, independent Consultant Geologist
- James McAteer, Gavin and Doherty Geosolutions



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Hydrometric Area Local Authority		Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
26 –Shannon Upper Roscommon County Council		Rivers: Anaderryboy River, Lung River Streams: Several unnamed streams Lakes: Loughannaganny Lake, Errit Lough, Cloonagh Lough	Errit Lough SAC Errit Lough pNHA	5.46
Topography	The Errit Lough sand and gravel body occupies a number of relatively flat-topped, well drained ridges in the vicinity of Errit and Cloonagh Loughs in northwest County Roscommon, set at elevations between 80 m and 100 m AOD (Figure 1). The aquifer body bounds the southern and eastern margins of Errit Lough and is also present along the northeastern edge of Cloonagh Lough. The ridges are surrounded by extensive tracts of cutover raised peat, and the Anaderryboy River flows from west to east from Errit Lough in a wide, meandering loop around the sand and gravel body.			
Geology and Aquifers	Aquifer categories	Based on its areal extent, inferred thickness, saturated thickness, groundwater throughput and position in the landscape the deposit is classified as Locally Important Sand and Gravel Aquifer (Lg) (DELG/EPA/GSI, 1999; GSI, 2017). There are borehole data available on the thicknesses of the sand and gravel deposit within the southern portion of the body.		
	Main aquifer lithologies	The sand and gravel body is comprised of glaciofluvial sands and gravels derived chiefly from limestones (GLs), which are basic in chemical reaction.		
	Key structures	The aquifer exposures consist of thickly bedded, unconsolidated, sheets of sands and pebble gravels.		
	Key properties	The specific capacity of the sands and gravels at Gortaganny Group Water Scheme is 678 m ² /d/m, and transmissivity is estimated to be in the order of 800 m ² /d (Kelly and Kabza, 2014). The lakes, streams and rivers in the immediate area suggest a water level at a relatively shallow depth, at least on the margins of the sand and gravel body. The water levels within these surface water bodies have allowed for inferences to be made on the degree of saturation, and it is inferred that approx. 35 % of the aquifer area has a depth of saturated sand and gravel greater than 5 m (Figure 2). Sand and gravel aquifers generally consist of unconsolidated coarse grained material, usually containing less than 8% fines (Ó'Súilleabháin, 2000).		
Overlying Strata	Thickness	There are data available from one borehole in the southern portion of the feature, with this indicating 27 m depth of sands and gravels (GSI, 2023, Figure 1). A geophysical survey suggests up to 14 m depth of sands and gravels exist at Gortaganny Group Water Scheme (O'Connor, 2007), and given these data, as well as the topography, the thicknesses of sand and gravel are likely to be greater than 10 m over much of the aquifer extent.		
	Lithologies	Approximately 30% of the aquifer is overlain with cutover raised peat, with sand and gravel assumed beneath.		
	Thickness	The cutover raised peat is assumed to be less than 3 m thick across all of the aquifer area. The thickness of the cutover raised peat is likely to decrease along the footslopes of the sand and gravel ridges.		
	% area aquifer near surface	Approximately 70% of the sand and gravel aquifer is at the surface, with the remainder beneath the cutover raised peat.		
Recharge	Vulnerability	The groundwater vulnerability of the sand and gravel is 'Extreme' where the water table is inferred to be < 3 m from the surface, this accounts for 13% of the aquifer area. In all other areas where the water table is at a depth > 3 m, the vulnerability is classed as 'High' (87% of the area, Figure 3).		
	Main recharge mechanisms	Diffuse recharge occurs <i>via</i> rainfall percolating through the unsaturated sand and gravel. Due to the high permeability of sand and gravel, a high proportion of the available recharge will percolate down to the water table. In the areas of the aquifer that is covered by overlying strata of cutover peat, a much lower proportion of the available recharge will percolate down to the water table.		



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	Est. recharge rates	The annual average rainfall for the aquifer is 1,247 mm (Walsh, 2012), thus providing an estimated diffuse groundwater recharge rate of 612 mm/yr. The minimum groundwater throughput in this aquifer is consequently estimated to be 3,225 m ³ /d.
Discharge	Large springs and large known abstractions (m³/d)	Gortaganny Group Water Scheme is served by a spring which discharges groundwater into Errit Lough. The maximum yield/discharge is estimated to be 200 m ³ /d, and the current abstraction from the spring is approximately 90 m ³ /d (Kelly and Kabza, 2014).
	Main discharge mechanisms	Groundwater discharges to a number of small, lowlying springs which are dotted throughout the edges of the aquifer body on the OSI 6 inch raster map (1830s – 1930s) at, for example Tully and Derreenamackaun Townlands. The rivers and streams that pass through and surround the aquifer are also expected to accept groundwater discharge.
	Hydrochemical Signature	There was a raw water sample taken from Gortaganny Group Water Scheme in August 2014, and the key hydrochemical parameters are; the water has a calcium bicarbonate (CaHCO ₃) signature, which is Moderately Hard; Alkalinity is 332 mg/l CaCO ₃ ; Total Hardness is 335 mg/l CaCO ₃ ; and Electrical Conductivity @20°C is 550 µS/cm (Kelly and Kabza, 2014).
Groundwater Flow Paths		The length of flow paths depend on the extent of the sand and gravel deposit. In general, locally important sand and gravel aquifers are expected to have relatively short flow paths <i>i.e.</i> up to several hundred metres. Given the topography of the sand and gravel body at Errit Lough, and the pattern of streams in the locality, this is also expected to be the case here.
Groundwater & Surface water interactions		Owing to the presence of small springs at the aquifer edges, hydraulic connection between the groundwater and the streams is considered to be high.
Conceptual model	- The Errit Lough sand and gravel body occupies a number of relatively flat-topped features set within a wider area of flat, cutover peat terrain. - The topography consists of ridges of hummocky, glaciofluvial sand and gravel deposits, situated at elevations between 85 m to 100 m AOD. - The sand and gravel deposits are known to be deep at the southern end of Errit Lough, with at least 27 m depth of sand and gravel measured in Derreenamackaun Townland (GSI, 2023, Figure 1). - It is inferred that approx. 35% of the aquifer area has a depth of saturated sands and gravels greater than 5 m, with the remainder of the aquifer inferred to have a saturated thickness less than this. - Groundwater discharges via a number of springs as shown on the OSI 6 inch raster map (1830s – 1930s), with Gortaganny Group Water Scheme being the largest of these at the eastern edge of the Errit Lough (Figure 1). - Specific capacity at Gortaganny Group Water Scheme is 678 m²/d/m, and transmissivity is estimated to be in the order of 800 m²/d (Kelly and Kabza, 2014). 90 m³/d is abstracted here. - The minimum groundwater throughput in this aquifer is estimated to be 3,225 m³/d.	
Attachments	Figure 1: Location and extent Figure 2: Cross section Figure 3: Groundwater vulnerability	
Instrumentation	Hydrometric gauges: National Water Monitoring Stations: River: Groundwater: Lake:	None present RS26A030100 (Cloonroe Bridge) None present LS260155a21400010 (Errit_M_1) LS260155a21400020 (Errit_M_2) LS260155a21400040 (Errit_M_4) LS260155a21400050 (Errit_M_5)

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Information Sources	• DELG/EPA/GSI (1999). Groundwater Protection Schemes. Department of the Environment and Local Government, Environmental Protection Agency and Geological Survey Ireland. • EPA map viewer. https://gis.epa.ie/EPAMaps/ • GSI (2017). A description of Irish aquifer categories. 3 pp. Available from: https://www.gsi.ie/documents/GSI%20Aquifer%20Category%20Descriptions.pdf • GSI (2023). Geological Survey Ireland, Internal groundwater databases. • Kelly, C. and Kabza, M. (2014). Establishment of Groundwater Zones of Contribution, Gortaganny Group Water Scheme, Co. Roscommon. Geological Survey Ireland Report to The National Federation of Group Water Schemes. • NPWS viewer. http://webgis.npws.ie/npwsviewer/ • Ó'Súilleabháin, C. (2000). Assessing the boundary between high and moderately permeable subsoils. Unpublished MSc., University of Dublin. Department of Civil, Structural and Environmental Engineering, Trinity College Dublin. • O'Connor, T.J. (2007). Roscommon GWS DBO Bundle, Gortaganny GWS Proposed Yield-Test Results. Completed by TJ O'Connor & Associates. • Walsh, S. (2012). A Summary of Climate Averages 1981-2010 for Ireland, Climatological Note No.14, Met Éireann, Dublin.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations and assumptions based on the information sources described above and established hydrogeological formulae. Figures 1, 2 and 3 are used for illustrative purposes only.

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Errit Lough Sand and Gravel Aquifer

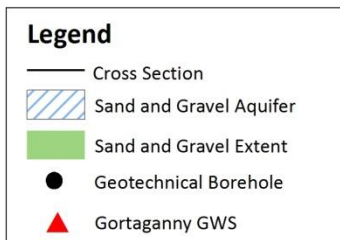
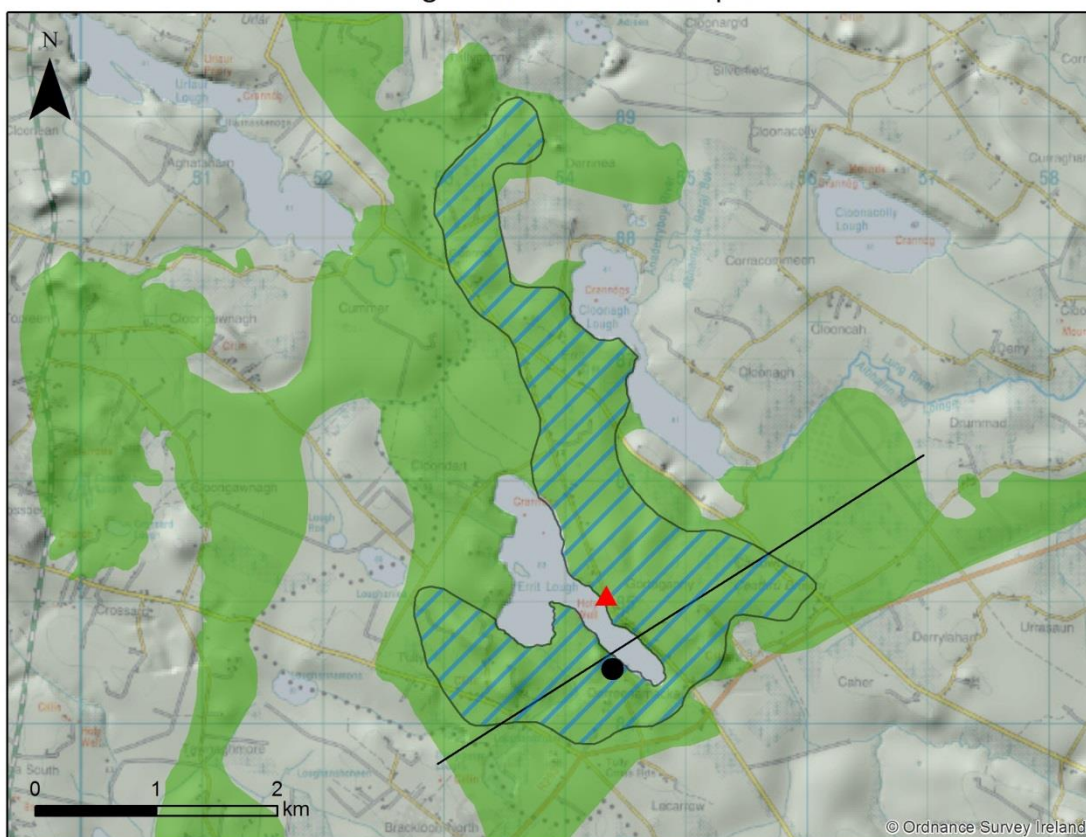


Figure 1: Errit Lough Sand and Gravel Aquifer extent with cross section location.



Figure 2: Cross section through the Errit Lough Sand and Gravel Aquifer body.

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Errit Lough Sand and Gravel Aquifer Vulnerability

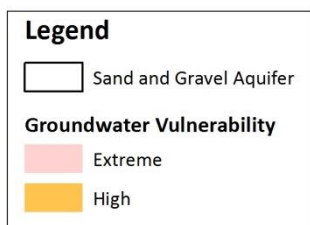
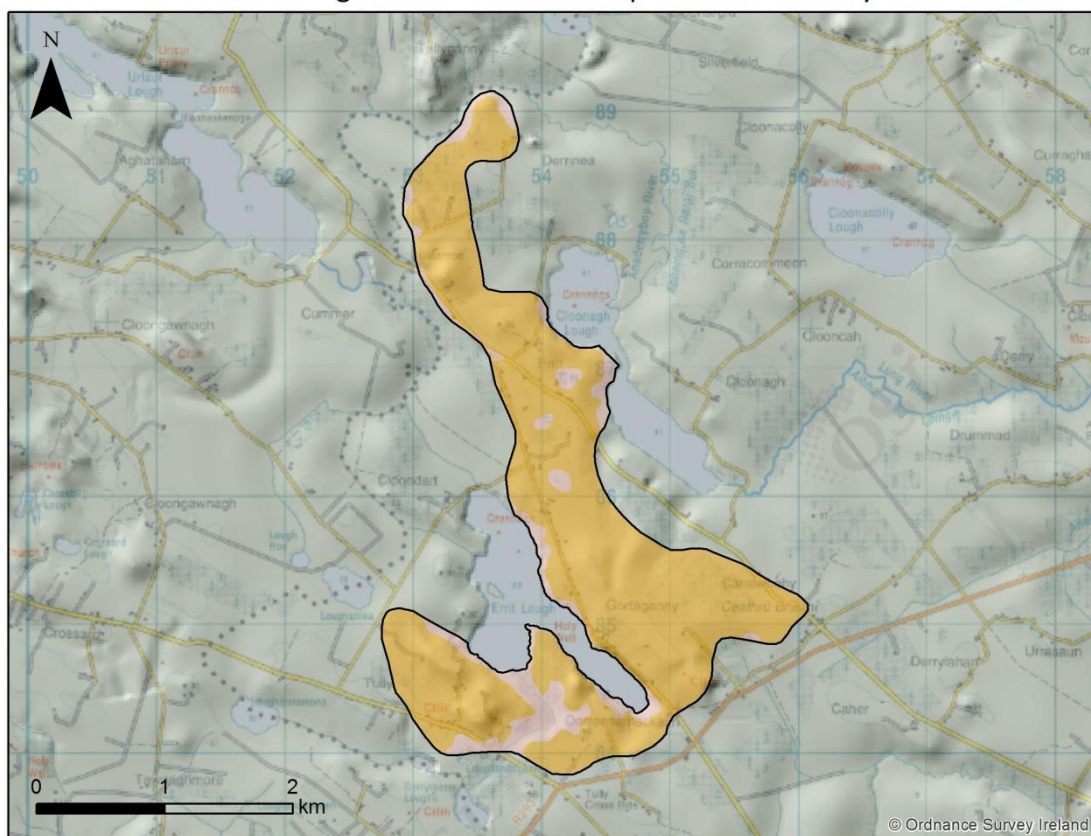


Figure 3: Groundwater vulnerability across the Errit Lough Sand and Gravel Aquifer.